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Logbook analysis for the 1990 4WX herring purse seine fishery

by

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ABSTRACT

This report summarizes the results of Scotia-Fundy Region purse seine logbooks from the 1990 season, and compares them with results from the previous 5 years of use. Logbooks were received for most trips from all 40 active vessels and the information was generally complete. Log records show that the purse seine fishery was similar in timing and location to recent years, with the exception of a concentration of effort in the central Bay of Fundy (Yankee Bank area) in July and August. Anecdotal comments on the log included several records of "lots of small fish" and may indicate a potential source of information on the relative strength of incoming year-classes.

Comparison of the 6-year time series of logbook information documents the changes in relative contribution of individual fishing grounds over this time; including the demise of Trinity Ledge and corresponding increases in importance of Long Island and Seal Island grounds. Analysis of catch rate information has been compromised by misreporting of the amount of fish landed.

RÉSUMÉ

Le présent rapport résume les résultats de l'analyse des journaux de bord des pêcheurs à la senne coulissante et les compare avec ceux des cinq années antérieurs. Ces journaux portaient sur la plupart des sorties des 40 bateaux en activité et contenaient dans l'ensemble des renseignements complets. Il révèlent des similitudes avec les pêches de ces dernières années, quant aux lieux et aux périodes de pêche, exception faite d'un effort concéntré dans le milieu de la baie de Fundy (secteur du banc Yankee) en juillet et août. Plusieurs des commentaires relevés font état de «nombreux poissons de petite taille», ce qui pourrait éventuellement nous renseigner sur la force relative des classes d'âge futures.

Une comparaison des données provenant des journaux de bord des six dernières années dénote des changements dans les apports relatifs des divers bancs de pêche au cours de cette période, notamment un déclin de la pêche sur la chaussée Trinity et une augmentation correspondante d'activité aux alentours des îles Long et Seal. L'analyse des taux de prises n'a pu être effectuée, les chiffres des débarquements ayant été faussés.

INTRODUCTION

The Scotia-Fundy Region herring purse seine logbook, first introduced in 1985 (see Power and Stephenson 1986, 1987, 1990), was used for the sixth consecutive year. As in previous years, logbook submission was a condition of the (weekly) purse seine license, and logs were submitted through fishery officers or licensing offices to the St. Andrews Biological Station for processing. All logs were coded by personnel knowledgeable of the fishery and care was taken to ensure that all fields were interpreted correctly and consistently. Logs were matched where applicable with corresponding commercial samples for access to length-frequency and biological detail information. As has been done since 1987, comments were formally coded to allow quantification of anecdotal information including school size, abundance and fish behaviour. A further improvement in quality has been achieved since 1988 through better editing verification and more complete assignment of catch locations to fishing grounds.

LOGBOOK COVERAGE AND SUMMARY OF RESULTS

Logbooks were received for most trips from all 40 vessels active in the 1990 fishery. One vessel (Cleland G) was inactive, and another (Mattuna Mariner) was replaced by the Canada Park.

"Kept" (i.e. sold) catch recorded on logs accounted for almost all (97%) of the official statistics recorded for the summer purse seine fishery (Table 1).

Comparisons of purchase slip totals and log records for each vessel and for each fishery (Table 2) demonstrate that the log is capturing most of the purchase slip information (i.e. reported landings), although this is known to be an underestimate of actual landings in 1990 (see Stephenson et al. 1991). Quota reports compiled by Yarmouth Statistics Coordinator for each vessel were compared with kept (i.e. landed) catches recorded in the logbooks. The text table below demonstrates that the quality of catch recording for 1987-90 has actually improved with more boats in the top 90-100% category:

	% of reported catch logged					Total #
	<59	60-69	70-79	80-84	90-100	boats
# boats 1987	4	4	3	12	17	40
# boats 1988	4	4	3	10	19	40
# boats 1989	8	1	1	4	25	39
# boats 1990	1	2	3	6	27	40

Logbooks were generally well completed, as has been the case in previous years (Table 3). There has been a slight decrease in

the completion of search time and in the lat/long field (although there has been sufficient information to interpret location).

DESCRIPTION OF THE FISHERIES

Log records show that the Chedabucto Bay fishery took place in the usual location - but was concentrated more in the Nov./Dec. period than in Jan./Feb. (Fig. 1A, 1B; Table 4). Catch was higher, although total searching was lower.

The Bay of Fundy fall and winter fishery ("4Xb") (Fig. 2A, 2B; Table 4) was concentrated around Grand Manan and the Wolves. Total landings and effort continued to increase consistent with the increased quota in this fishery.

The major 4X summer fishery was concentrated off SW Nova Scotia (German Bank and Seal Island), the Long Island Shore, mid Bay of Fundy and the upper Bay of Fundy (Fig. 3). The fishery followed the usual temporal pattern shown in Fig. 4A and Table 4:

June - Pre-spawning herring on the Long Island shore.

July -Pre-spawners along the Long Island shore, and spawning "Scots Bay" herring in the upper Bay of Fundy.

Aug. - A mixture of pre-spawning and roe herring along the SW Nova Scotia coast, particularly spawning herring in the Seal Island area.

Sept.-Oct. - Spawning herring from German Bank.

An unusual event for 1990 was the concentration of effort in the mid-Bay (Yankee Bank) area in July and August. A summary of monthly catches by fishing ground (Table 5; Fig. 4B) shows the dominance of Seal Island, Long Island, German Bank and Scots Bay areas - and the relative absence of a Trinity Ledge fishery which used to be dominant (the area was closed for much of Aug. and Sept.). Table 6 shows the relative dominance of markets, and Figs. 5 (A-C) show the location of sets for the roe, adult shore and OSS markets.

ANECDOTAL INFORMATION

The occurrence of comments on the logs (Table 7) and reasons for released sets or lack of catch (Table 8) allow some quantification of anecdotal information. A new comment (in the four years of records) "lots of small fish" appeared on 22 log records (1%) in 1990 and may indicate a potential source of information on incoming year-classes and their relative strength.

Release codes (Table 8) show a decrease in the dogfish problem over 1989 and an increase in the problem of fish diving (during large sets). "Size of fish" accounting for 4% of sets remains one of the main release reasons.

PERFORMANCE BY FISHING GROUNDS

Tables 9 and 10 compare the 6-year logbook series of catch, search hours, catch rate and set rate by fishing ground for all fisheries.

Chedabucto Bay landings have increased substantially (3 fold) over the time series - but there has been apparently little net change in search effort, catch rates or set rates.

The Bay of Fundy winter (4XS) fishery has seen an increase in landings accompanied by decreases in catch rate and set rate.

In the summer fishery the relative contribution (by catch) of individual fishing grounds has changed drastically over the time series (Table 11). Trinity Ledge which made up 43% of total catch in 1985 now makes up only 1%. On the other hand, there have been increases in the proportion and total catch levels in the Long Island and Seal Island grounds (now 25 and 34% of total catch respectively). Catch rates are not considered useful because of the misreporting which has occurred (i.e. logbook catch = purchase slip catch which has been documented as incorrect; Stephenson et al. 1991). Set rate (sets/hr) which is postulated to reflect encounter rates, and therefore possibly abundance, does not appear useful. For example, there has been relatively little change in sets/hr on Trinity Ledge over the time series in spite of a recent decline in catch and abundance in the area.

CONCLUSIONS

The use of herring logbooks in documenting various aspects of the fishery has been very valuable to the 4WX herring assessment. Without logbooks we would have very little data on the spatial distribution of the catch and effort for this major gear component (95% of stock catches in the 1990 fishery), and other important aspects of the fishery such as markets sought, reasons for release of fish, anecdotal observations and details of size and condition of fish would be poorly known.

Problems with catch recording on purchase slips noted in the assessment (Stephenson et al. 1991) are also evident in logbooks, and further compromise efforts to create a valid CPUE index. It is hoped that other indices which are independent of catch (i.e. set or encounter rates) may prove useful in the future.

ACKNOWLEDGMENTS

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Table 1. Historical herring logbook coverage for the 4WX purse seine fisheries.

Year	Total # Nights Fishing	Total # Successful Nights	% of Successful Nights	Total # of Sets	Total Logbook Catch(t)	Total Statistics Catch(t)	% of Logged Catch	Catch per Night	Catch per Successful Night	Catch per Set	Total Search Hours	Catch per hr. Searched	Sets per hr. Searched
1967						117832				55.4 a			
1968						133267				52.8 a			
1969						84525				41.7 a			
1970						74849				39.0 a			
1971						35071				32.6 a			
1972						61158				45.0 a			
1973	403	363	90%	550	17603	36618	48%	43.7	48.5	32.0 a			
1974 b						76859				53.4 a			
1975 b						79605				57.4 a			
1976 b						58395				44.6 a			
1977	1137	863	76%	1203	32143	68538	47%	28.3	37.2	26.7			
1978	701	551	79%	950	21734	57973	37%	31.0	39.4	22.9			
1979	641	261	41%	422	8565	25265	34%	13.4	32.8	20.3			
1980	1273	1134	89%	1399	32921	44986	73%	25.9	29.0	23.5			
1981	638	539	84%	706	18764	53799	35%	29.4	34.8	26.6			
1982	229	160	70%	320	6751	64344	10%	29.5	42.2	21.1			
1983	1348	1207	90%	1772	47071	63379	74%	34.9	39.0	26.6			
1984	530	503	95%	730	26560	58354	46%	50.1	52.8	36.4			
1985	1802	1539	85%	2297	83323	87167	96%	46.2	54.1	36.3	5157	26.6	0.62
1986	1424	1258	88%	1852	51625	56139	92%	36.3	41.0	27.9	4519	18.1	0.59
1987	1796	1540	86%	2218	68257	77306	88%	38.0	44.3	30.8	5753	19.5	0.59
1988	1916	1666	87%	2908	85741	98371	87%	44.8	51.5	29.5	5868	22.7	0.55
1989	1609	1333	83%	1916	64207	68089	94%	39.9	48.2	33.5	5333	15.0	0.51
1990	1742	1436	82%	2240	74907	77545	97%	43.0	52.2	33.4	6096	9.3	0.43

a - From Stephenson et al., 1986.

b - Data only available from area 4W logbooks.

Table 2. 1989-1990 4VWX monthly herring Statistics Division and purse seine logbook catches (t).

		1989					1990								
Fishery	Data Source	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
4W	Statistics Branch		3484	3292	1540									10327	4461	23104
4W	Kept Catch, Logbooks		3257	2254	906									8336	3449	18202
	Ratio "Stats"/"kept"		1.1	1.5	1.7									1.2	1.3	1.3
4Xa	Statistics Branch	9442						92	9739	23616	8022	28404	7672			86987
4Xa	Kept Catch, Logbooks	7763						243	9172	20691	7955	28305	6877			81006
	Ratio "Stats"/"kept"	1.2						0.4	1.1	1.1	1.0	1.0	1.2			1.1
4Xb	Statistics Branch	1311	1456	56	3617	4265							530	626	554	12415
4Xb	Kept Catch, Logbooks	458	278	0	3086	1926							283	404	480	6915
	Ratio "Stats"/"kept"	2.9	5.2	n/a	1.2	2.2							1.9	1.5	1.2	1.8
4VN	Statistics Branch		296	1782										4712		6790
4VN	Kept Catch, Logbooks		360	970										3591		4921
	Ratio "Stats"/"kept"		0.8	1.8										1.3		1.4

Table 3. Summary of data coverage by field for 1985-1990 4VWX herring purse seine logbooks.

Field	Occurence in 1990	Percent occurence					
		1985	1986	1987	1988 (1)	1989 (2)	1990 (3)
Vessel (4)	43 of 43; 2211 trips	100	100	100	96	98	100
Departure date	2211 of 2211 trips	100	100	100	100	100	100
Trip time (hrs)	1648 of 2211 trips	83	80	81	79	75	76
Search time (hrs)	1321 of 2211 trips	65	71	71	65	64	60
Set date	2150 of 3084 records	81	86	76	69	72	70
Set number	2863 of 3084 records	91	94	93	94	92	93
Start set time	2147 of 3084 records	75	78	74	68	72	70
Position type	unspecified	4	2	0.4	0.1	0.5	0
	lat/long	8	6	18	44	46	36
	Loran C	32	30	31	20	18	18
	Square #	15	13	17	10	5	7
	Interpreted	41	38	35	26	31	39
Total catch/set	2520 of 3084 records	84	84	84	84	81	82
Kept catch/set	2482 of 3084 records	82	84	82	83	80	80
Release catch/set	48 of 3084 records	3	1	3	2	3	2
Catch units	unspecified	56	16	17	16	18	18
	Metric ton	6	3	6	15	14	10
	Short ton	38	81	78	68	68	71
	Hogshead	0.2	0.3	0.1	1	1	1
Release code	790 of 3084 records	21	20	28	25	29	26
Size of fish	0	19	20	23	28	42	35
Roe condition	634 of 3084 records	14	27	28	20	18	21
Market code	2666 of 3084 records	76	84	78	95	85	86
Comments code	0	-	-	17	24	29	23

(1) 1988 summary also includes data from 4W, 4Xb, 4Vn and 1 midwater trawler (449 records).
(2) 1989 summary also includes data from 4W, 4Xb, 4Vn and 1 midwater trawler (513 records).
(3) 1990 summary also includes data from 4W, 4Xb, 4Vn and 1 midwater trawler (633 records).
(4) Includes 1 midwater trawler and 3 replacement vessels in past year.

Table 4. 1985 to 1990 4VWX herring purse seine total catch (t) and effort (sonar hours) by area and month.

Fishery	Month	1985	1986	1987	1988	1989	1990	1985	1986	1987	1988	1989	1990
		Total Catch in Tons						Total Searching in Sonar Hours					
4W	1	841	3593	2944	3059	2538	942	15	33	93	166	120	28
4W	2				406	14				8	43	2	
4W	11	2049	3164	2532	2811	3257	8282	84	110	117	138	62	84
4W	12	2071	1072	885	1043	2254	3246	54	54	29	38	31	19
4W	Total	4961	7829	6361	7319	8063	12470	153	197	247	385	215	131
4Xa	5			24	265	41	302				15	0	6
4Xa	6	428	316	4272	11065	9011	9321	29	43	359	723	709	767
4Xa	7	12926	7251	14136	23315	17045	21157	1277	699	1523	1510	1302	1587
4Xa	8	30054	17875	22179	19396	10987	8075	2158	1777	2242	1945	613	1387
4Xa	9	35590	23662	23656	32674	19360	28748	1558	1827	1473	1548	1018	1990
4Xa	10	4325	2520	4189	1789	7763	7304	139	170	210	128	296	360
4Xa	Total	83323	51624	68456	88504	64207	74907	5161	4516	5807	5869	3938	6097
4Xb	1	260		1634	2200	2233	3088			62	78	103	257
4Xb	2				1469	1726	1938				61	149	155
4Xb	3				1156	777					45	63	
4Xb	10	1292	2624	952	82	458	283	26	159	99	8	34	22
4Xb	11	221	486	488		278	404		42	23		14	31
4Xb	12			108		0	480			6			39
4Xb	Total	1773	3110	3182	4907	5472	6193	26	201	190	192	363	504
4VN	11	2554	3053	1470	980	360	3591		25	27		2	11
4VN	12	957	1433	281	1188	970			1	2	1	9	
4VN	Total	3511	4486	1751	2168	1330	3591	0	26	29	1	11	11

Table 5. 1990 4X summer purse seine monthly catches (t) by fishing grounds.

Fishery	Grounds	May	June	July	Aug.	Sept.	Oct.	Total
4Xa	Grand Manan			454	15		408	877
4Xa	Long Island		8719	8657	929	377	73	18755
4Xa	Trinity		95	185	834	0		1114
4Xa	Lurcher		38	27				65
4Xa	Gannet, Dry Ledge		125	182	885	2732	240	4164
4Xa	Seal Island		0	1426	2656	15468	5772	25322
4Xa	German Bank	155	344	112	231	10090	311	11743
4Xa	Scots Bay			7421	1422	82		8925
4Xa	N.B. Coastal			27				27
4Xa	S.W. Grounds	56			0			56
4Xa	Yankee Bank			2559	1088			3647
4Xa	Unknown Area	91		107	16			214
4Xa	Total	302	9321	21157	8076	28749	7304	74909

Table 6. 1985 to 1990 market components for the 4X summer purse seine fishery from logbook data.

4X Market	1985	1986	1987	1988	1989	1990	1985	1986	1987	1988	1989	1990
	Kept tons. (1)						Percent kept tons					
Over-the-Side	7359	644	5072	21755	19149	13387	9	1	8	25	31	18
Sardine	1576	2548	1580	99	57	308	2	5	2	0	0	0
Bait	892	1472	1667	449	1950	855	1	3	3	1	3	1
Roe	25320	22723	28844	32509	12725	31523	32	44	44	38	21	43
Adult Shore	30867	20408	20619	29361	23383	25941	38	40	32	34	38	35
Fillet	32	45	240	410	651	50	0	0	0	1	1	0
U.S. Buyers	282	176	277	23	64	57	0	0	0	0	0	0
Unspecified	14144	3630	6675	1135	2202	125	18	7	10	1	4	0
Stringer					27	8					0	0
Split Markets					1035	351					2	0
Bloater						603						1
Barrel						36						0
Total	80472	51646	64974	85741	61243	73244	100	100	100	100	100	100

(1) Note the use of 'Kept tons' rather than 'Total tons' caught to reflect catches which actually 'went to market'.

Table 7. Summary of comment codes from 1987 to 1990 4X summer purse seine logbooks.

	Occurence on logs							
Year	1987	1988	1989	1990	1987	1988	1989	1990
Comment code	Number of records				Percent all records			
Not specified	1971	1991	1319	1730	82.7	75.5	68.8	77.2
Fish thinned out	50	44	21	16	2.1	1.7	1.1	0.7
Small bunches/schools	26	30	16	28	1.1	1.1	0.8	1.3
Large area of fish	194	172	144	115	8.1	6.5	7.5	5.1
Little or no fish	14	17	7	10	0.6	0.6	0.4	0.4
Poor bottom	15	13	3	6	0.6	0.5	0.2	0.3
Whales	16	3	6	3	0.7	0.1	0.3	0.1
Brit sighting	1		1		0.0	0.0	0.1	0.0
Large bunches/schools	40	41	17	28	1.7	1.6	0.9	1.3
Hard to catch	25	39	31	40	1.0	1.5	1.6	1.8
Fish on surface	5	6	12	3	0.2	0.2	0.6	0.1
Fish in shallow water	1	37	14	19	0.0	1.4	0.7	0.8
No feed in fish	21	122	152	72	0.9	4.6	7.9	3.2
Pooling of catch	3	66	34	19	0.1	2.5	1.8	0.8
Fish deep		21	23	37		0.8	1.2	1.7
Some feed in fish		30	35	25		1.1	1.8	1.1
Fish very fat		1		1		0.0	0.0	0.0
Gave fish away		3				0.1	0.0	0.0
F.O. hail			8				0.4	0.0
Split market			9	4			0.5	0.2
Catch not recorded			18	52			0.9	2.3
Warmer water than normal			5	3			0.3	0.1
Poor weather			17	1			0.9	0.0
Carrying			24				1.3	0.0
Too many boats				1				0.0
Lots of small fish				22				1.0
Recieved fish				5				0.2
Total number of records	2382	2636	1916	2240	100	100	100	100

Table 8. Release data for 1985 to 1990 4X summer purse seine logbooks.

Reason for release	Occurence on Logs % of total sets						Reported Releases % of released tonnage					
	1985	1986	1987	1988	1989	1990	1985	1986	1987	1988	1989	1990
No release code	78.8	80.4	72.5	74.2	74.8	77.5	4.5	0.0	11.1	2.6	0.9	n/a
Size of fish	3.0	1.0	1.6	1.3	4.2	3.5	41.7	2.9	8.1	13.1	42.5	43.2
Feed	1.1	0.1	1.1	2.1	0.8	1.3	6.2	0.0	2.2	4.6	2.1	1.1
Condition	0.9	2.5	3.1	2.5	1.7	1.0	0.6	41.2	26.1	38.6	6.1	7.1
Dogfish	1.7	0.6	0.8	1.0	4.0	2.0	6.9	2.0	1.9	3.4	12.2	1.9
Tore up	1.3	1.3	1.9	1.5	0.8	1.3	3.1	2.7	4.1	0.8	0.0	0.3
Set too large	0.4	0.4	0.9	0.9	0.3	0.4	16.2	3.7	31.9	18.5	0.9	1.6
Market filled	1.3	0.2	0.6	0.3	0.2		6.9	10.1	0.5	5.7	1.5	0.0
Skunk set	1.8	1.8	1.5	2.2	1.8	4.1	0.0	0.3	0.2	0.1	0.0	0.0
Other Species	0.1	0.4	0.3	0.1	0.2	0.3	0.8	0.0	0.0	0.0	0.0	1.4
Set too small	0.4	0.1	0.2	0.4	0.4	0.7	0.1	0.1	0.2	1.1	0.3	1.6
No fish found	3.3	3.7	2.7	3.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Fish too deep	0.9	1.8	2.4	1.4	1.2	1.2	0.1	0.1	0.0	0.3	0.0	0.0
Poor weather	0.9	0.8	1.9	0.9	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Gear/crew problems	0.6	0.9	1.4	1.4	1.9	1.3	0.1	7.8	3.0	0.0	0.6	0.1
Fish too shallow	1.1	0.4	1.9	1.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Fish dove		0.2	0.5	0.2	0.3	0.6		2.7	9.2	3.0	0.0	40.8
Net sunk	0.3	0.6	0.1	0.5	0.6	0.2	12.5	26.4	0.0	3.0	24.4	0.0
Fish thinned out		0.4	0.3	0.8	1.3			0.0	0.0	0.0	0.2	0.0
Fish moving fast		0.6	0.5	0.2	0.2	0.2		0.0	0.0	0.0	0.0	0.0
Fish inside box/line		0.3	0.3	0.2				0.0	0.0	0.0	0.0	0.0
Gave fish away				0.0	1.9	1.6			0.0	0.0	1.5	0.0
Pooling; no set made						0.1						0.0
Unknown reason	2.2	1.6	2.3	2.0	3.2	2.2		0.0	1.5	5.2	65.9	1.0
Total No. of Observations	2471.0	1964.0	2382.0	2636.0	1916	2240						
Total Released Catch (t)							2968.0	1341.0	3330.0	3012	2969	1669

Table 9. 4VWX herring logbook total catch (t) and effort (sonar hrs.) by area and grounds.

Fishery	Grounds	1985	1986	1987	1988	1989	1990	1985	1986	1987	1988	1989	1990
		Total Catch in Tons						Total Searching in Sonar Hours					
4W	Chedabucto Bay	4216	6871	4468	7319	8062	12470	135	164	181	385	233	131
4W	Unknown Areas	746	959	1893				17	32	66			
4W	Total	4962	7830	6361	7319	8062	12470	152	196	247	385	233	131
4Xa	Grand Manan	3584	2984	2217	301	968	877	184	284	220	27	77	75
4Xa	Long Island	857	3060	7309	10705	21719	18755	149	292	771	804	2371	1775
4Xa	Trinity	35800	13419	18851	18539	266	1113	2110	1650	1700	1498	97	260
4Xa	Lurcher	308			2928	18	65	39	8		162	14	9
4Xa	Gannet, Dry Ledge	5675	2187	1474	14901	2010	4163	526	203	162	1187	229	343
4Xa	Seal Island	13745	8894	11560	19019	23420	25321	718	542	1086	1137	1517	2035
4Xa	German Bank	15502	13346	16434	18392	8087	11744	679	873	985	797	644	886
4Xa	Scots Bay		36	3649	3949	6583	8925		5	256	184	310	352
4Xa	S.W. Grounds	558	1839	184	181	223	56	47	175	28	11	26	11
4Xa	N.B. Coastal		621	138	126	276	27		33	9	33	1	1
4Xa	Yankee Bank				194	196	3647				21	35	331
4Xa	Unknown Area	7294	5240	6443	0	440	214	709	452	561	0	6	19
4Xa	Total	83323	51626	68259	89235	64206	74907	5161	4517	5778	5861	5327	6097
4Xb	Grand Manan	1332	2814	2135	4197	3240	4505	26	169	125	162	194	388
4Xb	Long Island		252	215	18		7		32	10	3		
4Xb	Trinity	94											
4Xb	Gannet, Dry Ledge						50						
4Xb	Seal Island	123					23						
4Xb	German Bank			66			0			8			
4Xb	N.B. Coastal	188		966	692	2231	1608			74	27	167	115
4Xb	Unknown Areas	36	44	16						6			
4Xb	Totals	1773	3110	3398	4907	5471	6193	26	201	223	192	361	503
4VN	Sydney Bight	3511	4250	1751	2100	1330	3591		26	29	1	11	11
4VN	Unknown Area		236		68								
4VN	Total	3511	4486	1751	2168	1330	3591		26	29	1	11	11

Table 10. 1985 to 1990 4VWX herring purse seine catch rates and set rates by area and grounds.

Fishery	Grounds	1985	1986	1987	1988	1989	1990	1985	1986	1987	1988	1989	1990
		Catch per hour Searching						Sets per hour searching					
4W	Chedabucto Bay	42	71	39	34	25	36	0.8	1.1	0.9	0.7	0.9	0.9
4W	Unknown Areas	143	60	80				2.1	1.2	1.4			
4W	Average	68	69	52	34	25	36	1.1	1.1	1.1	0.7	0.9	0.9
4Xa	Grand Manan	28	22	19	9	52	10	0.7	0.8	0.6	0.3	1.0	0.5
4Xa	Long Island	16	23	14	21	10	10	0.4	0.9	0.5	0.6	0.4	0.4
4Xa	Trinity	29	11	13	18	9	4	0.7	0.4	0.5	0.5	0.5	0.4
4Xa	Lurcher	10			29	1	7	0.2			0.7	0.1	0.3
4Xa	Gannet, Dry Ledge	17	31	17	23	10	9	0.5	0.9	0.6	0.5	0.5	0.4
4Xa	Seal Island	29	20	16	17	18	11	0.6	0.6	0.5	0.5	0.5	0.4
4Xa	German Bank	30	21	32	35	12	14	0.6	0.6	0.7	0.7	0.4	0.5
4Xa	Scots Bay		8	25	28	24	24		0.2	0.5	0.6	0.8	0.5
4Xa	S.W. Grounds	34	15	12	13	11	0	0.8	0.5	0.3	0.4	0.3	0.0
4Xa	N.B. Coastal		33	26	5	n/a	0		0.5	0.6	0.2	n/a	2.0
4Xa	Yankee Bank				9	8	16				0.4	0.3	0.5
4Xa	Unknown Area	18	18	26		1	1	0.4	0.6	0.7		0.6	0.2
4Xa	Average	27	18	20	23	15	12	0.6	0.6	0.6	0.6	0.5	0.4
4Xb	Grand Manan	43	22	31	29	21	17	1.3	1.0	0.9	0.9	0.9	0.8
4Xb	Long Island		8	54	6				0.5	3.0	0.3		
4Xb	Trinity												
4Xb	Seal Island												
4Xb	German Bank			9						0.3			
4Xb	N.B. Coastal			11	6	13	13			0.4	0.5	0.5	0.5
4Xb	Unknown Area			3						0.2			
4Xb	Average	43	20	26	26	18	16	1.3	0.9	0.9	0.9	0.7	0.8
4VN	Sydney Bight		55	30	45	56	70		1.1	0.7	1.0	1.0	1.1
4VN	Unknown Area												
4VN	Average		55	30	45	56	70		1.1	0.7	1.0	1.0	1.1

Table 11. Changes in the relative importance of key fishing grounds in the 4X summer purse seine fishery.

Fishery	Grounds	1985	1986	1987	1988	1989	1990	1985	1986	1987	1988	1989	1990
		Total Catch in Tons						Total Searching in Sonar Hours					
4Xa	Long Island	857	3060	7309	10705	21719	18755	149	292	771	804	2371	1775
4Xa	Trinity	35800	13419	18851	18539	266	1113	2110	1650	1700	1498	97	260
4Xa	Seal Island	13745	8894	11560	19019	23420	25321	718	542	1086	1137	1517	2035
4Xa	German Bank	15502	13346	16434	18392	8087	11744	679	873	985	797	644	885
4Xa	Scots Bay		36	3649	3949	6583	8925		5	256	184	310	352
4Xa	Yankee Bank				194	196	3646				21	35	331
4Xa	Total all areas	83323	51626	68259	89235	64206	74907	5161	4517	5778	5872	5338	6096
		Percentage of Total Catch						Percentage of Total Searching					
4Xa	Long Island	1	6	11	12	34	25	3	6	13	14	44	29
4Xa	Trinity	43	26	28	21	0	1	41	37	29	26	2	4
4Xa	Seal Island	16	17	17	21	36	34	14	12	19	19	28	33
4Xa	German Bank	19	26	24	21	13	16	13	19	17	14	12	15
4Xa	Scots Bay	0	0	5	4	.10	12	0	0	4	3	6	6
4Xa	Yankee Bank				0	0	5				0	1	5
4Xa	Total all areas	79	75	85	79	94	93	71	74	83	76	93	92

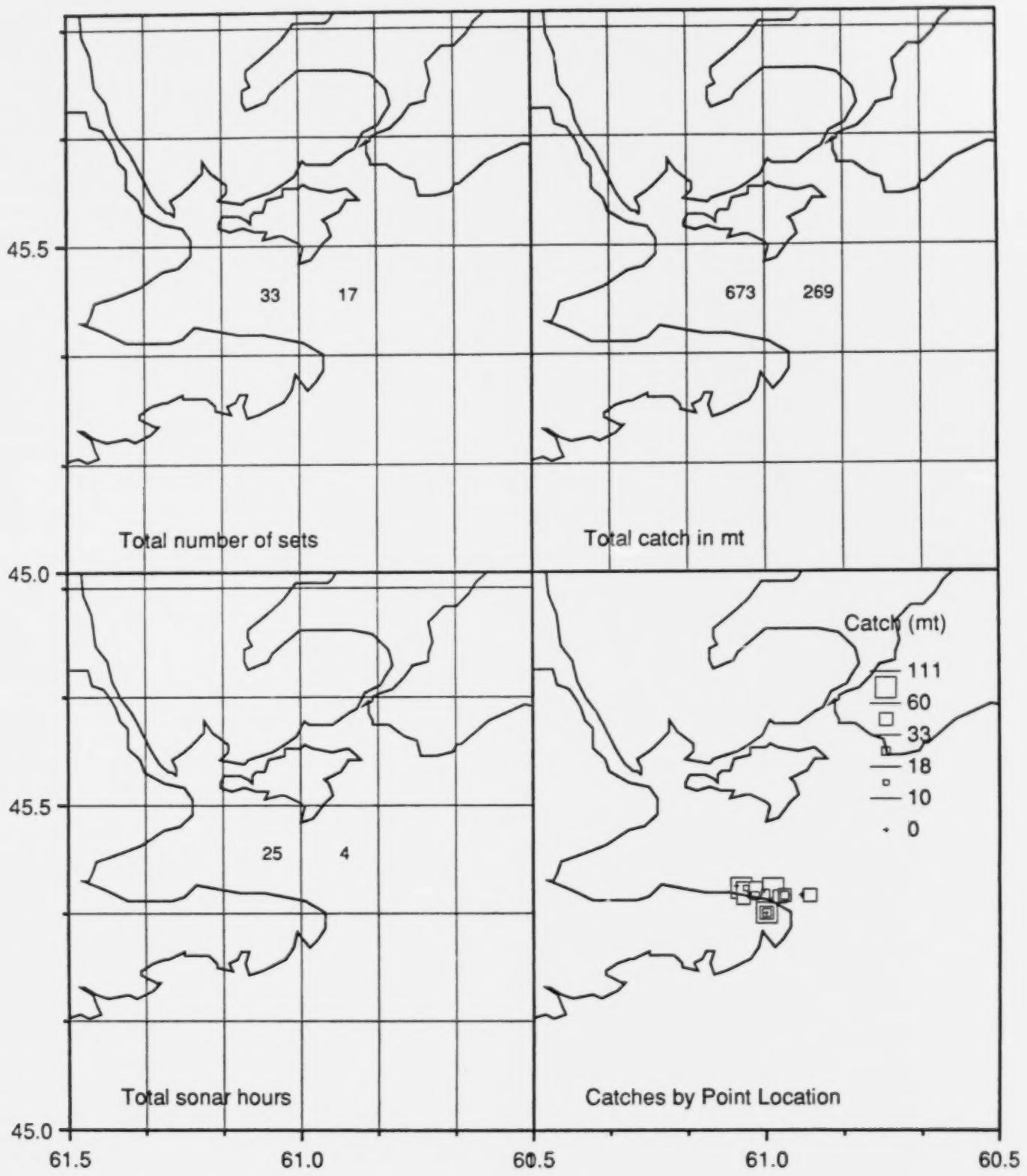

Figure 1a. 1990 4W purse seine catch and effort distribution (winter only).

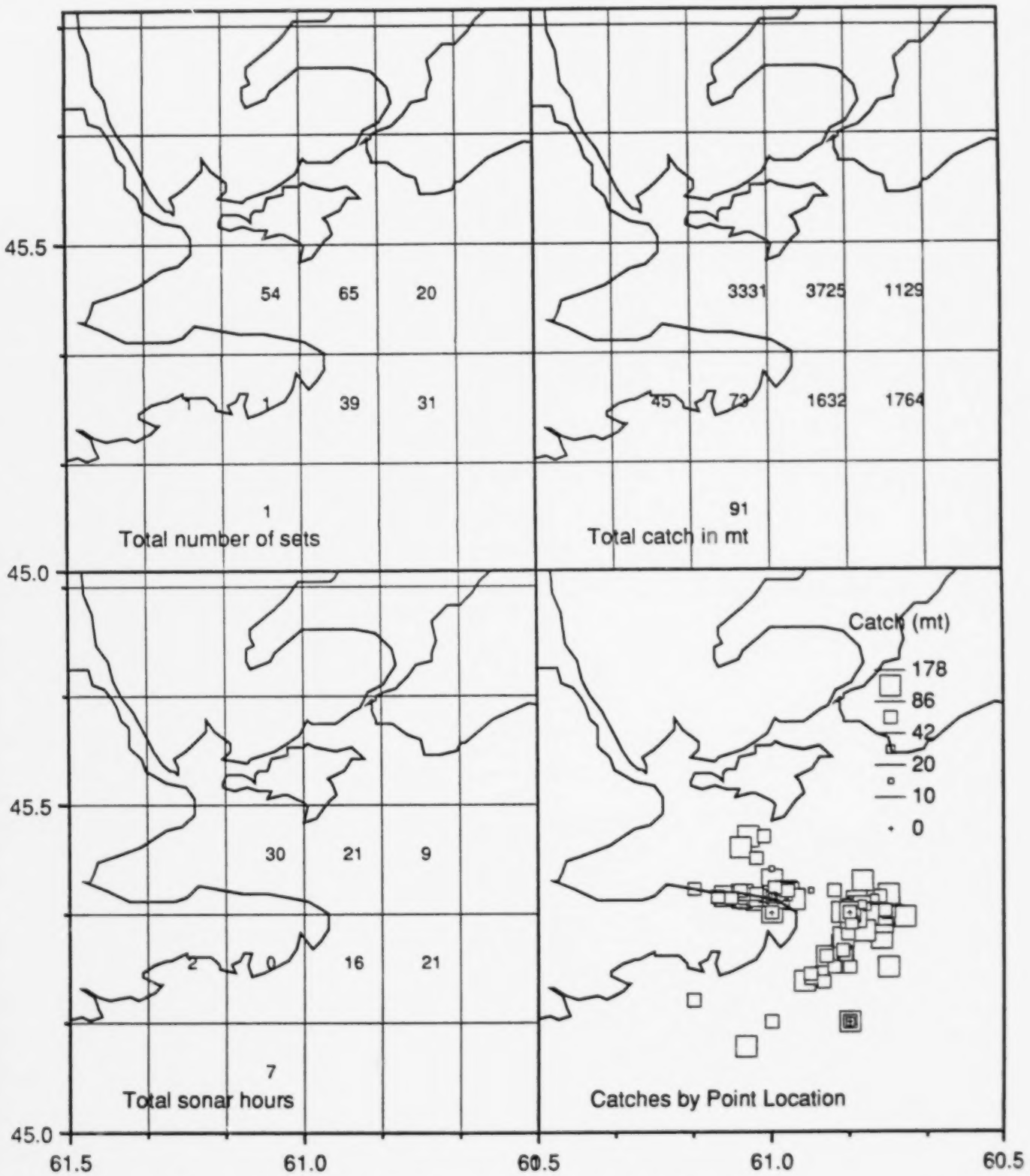

Figure 1b.1990 4W purse seine catch and effort distribution (fall only).

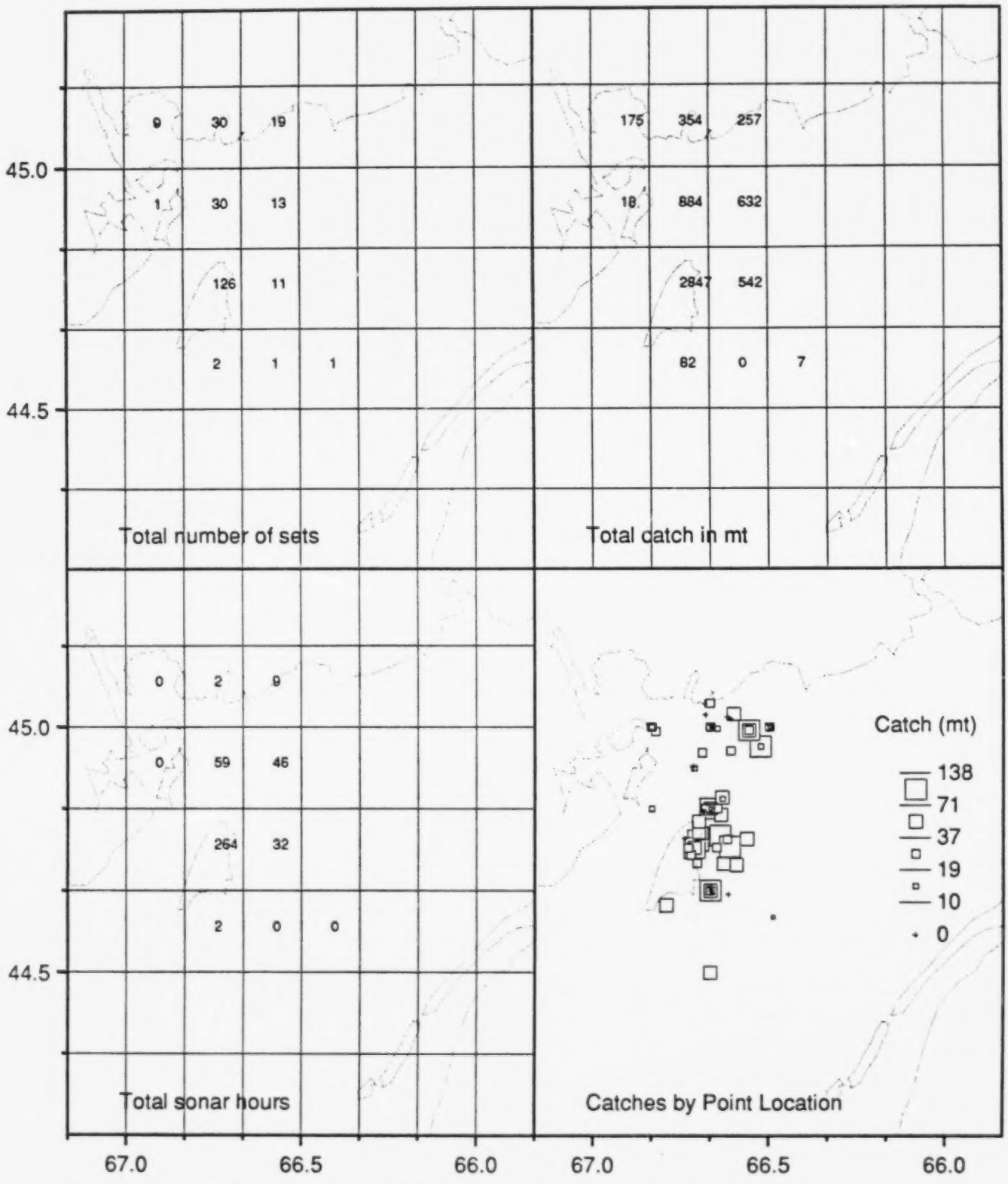

Figure 2a. 1990 4XB purse seine catch and effort distribution (Winter only).

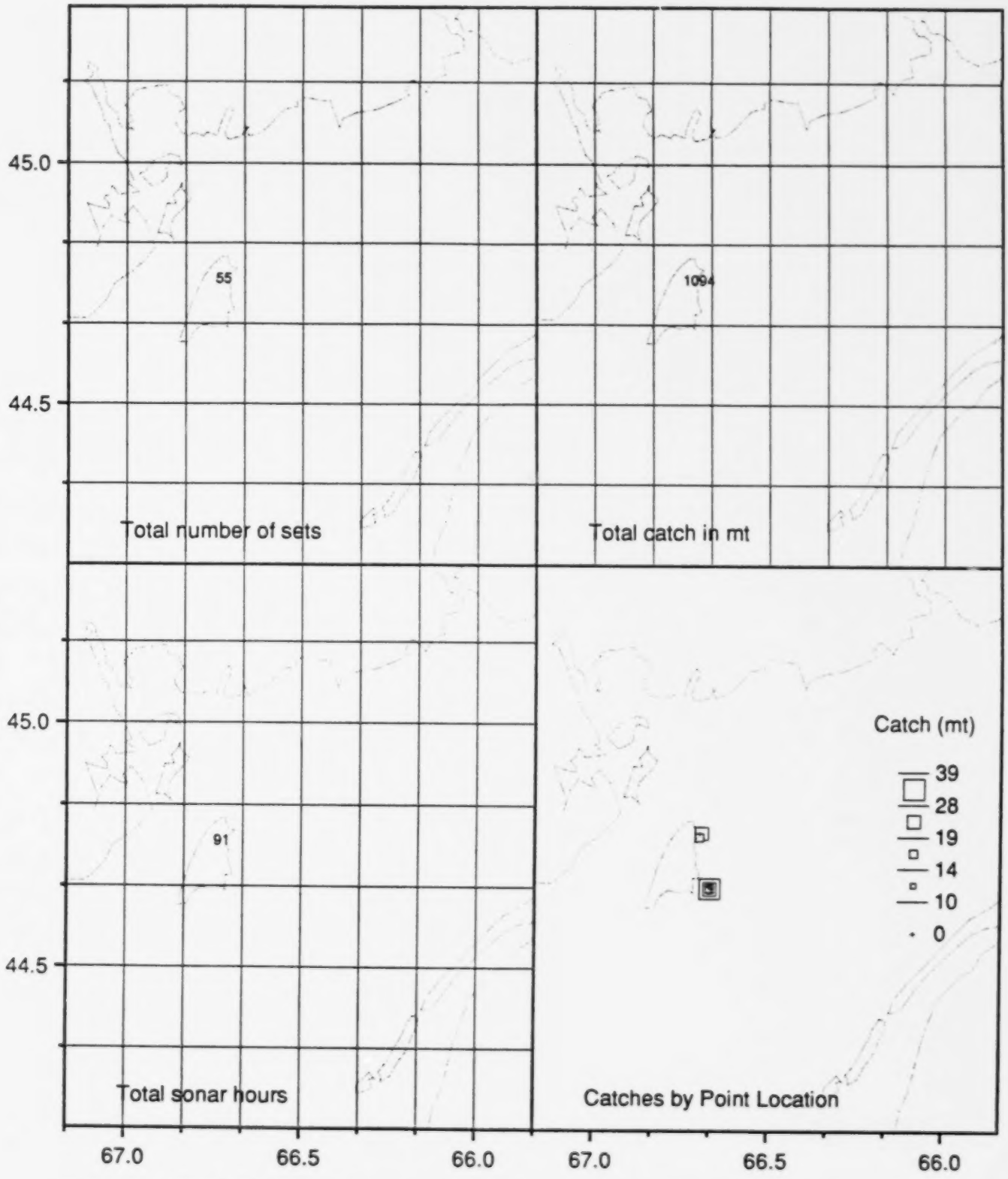

Figure 2b. 1990 4XB purse seine catch and effort distribution (Fall only).

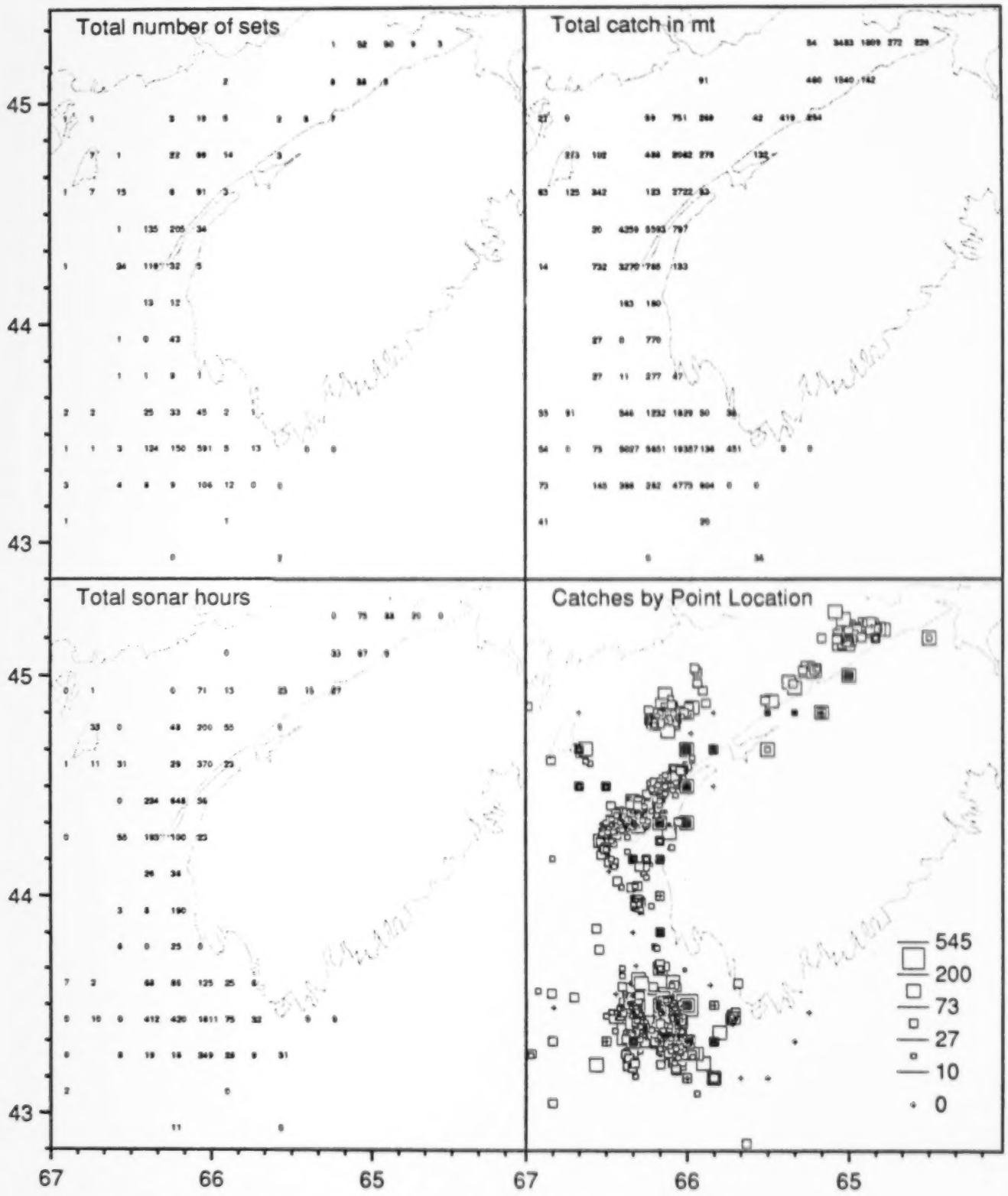

Figure 3. 1990 4XA purse seine catch and effort distribution.

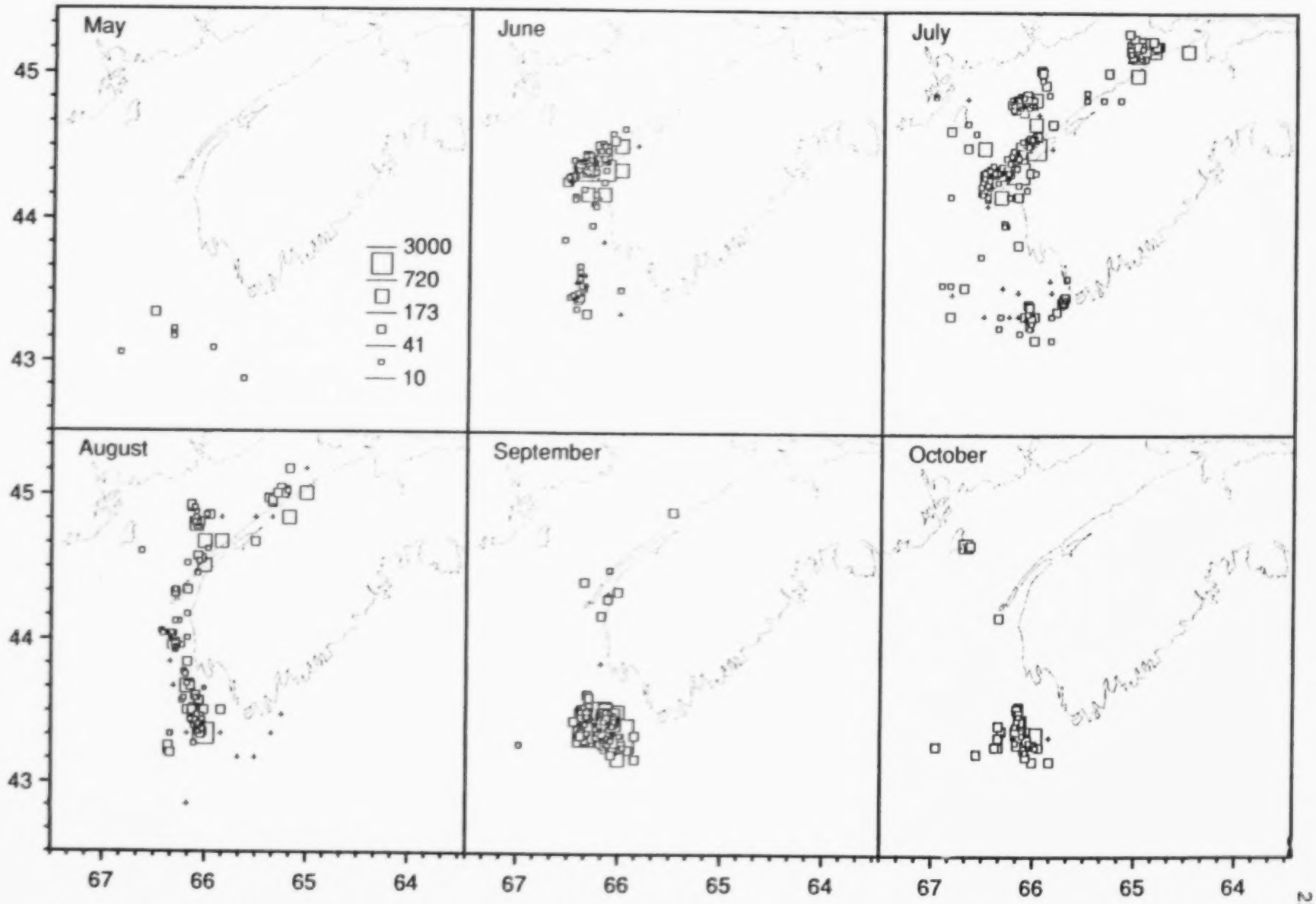

Figure 4a. 1990 4Xa purse seine monthly catches by 1 mile squares.

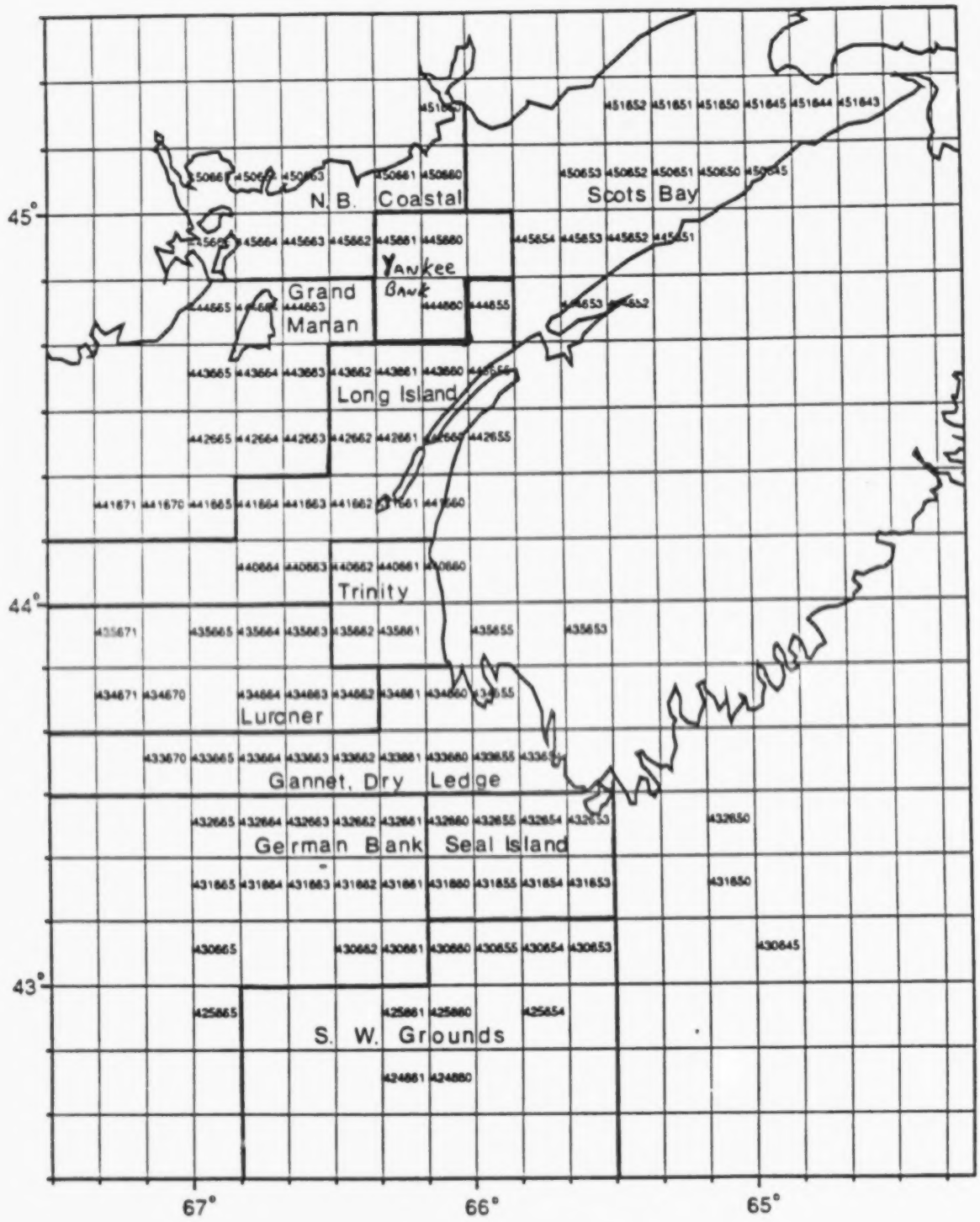

Figure 4b. 4X summer purse seine fishing grounds and 10 minute squares.

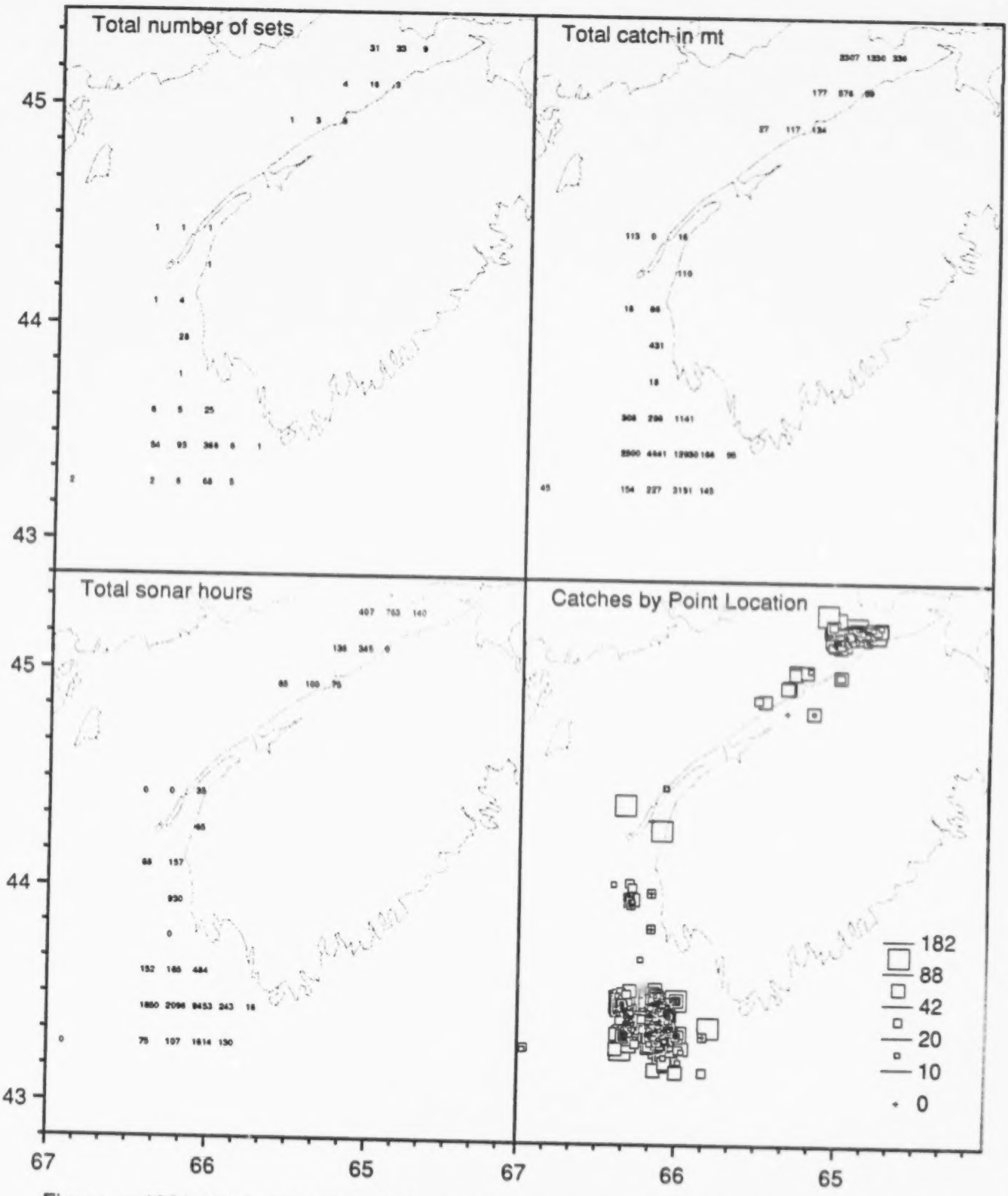

Figure 5a.1990 4XA purse seine catch and effort distribution for ROE market.

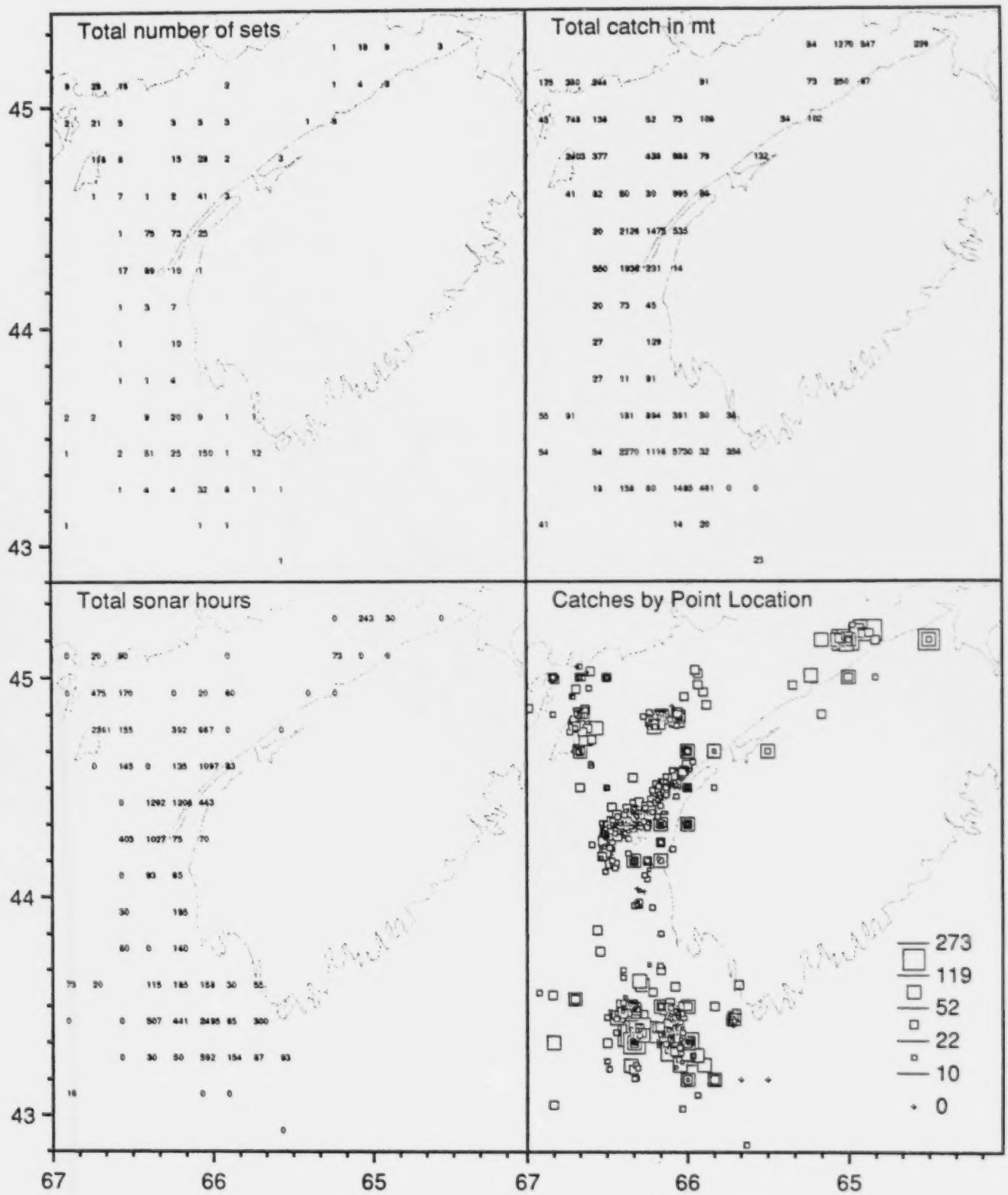

Figure 5b. 1990 4XA purse seine catch and effort distribution for SHORE market.

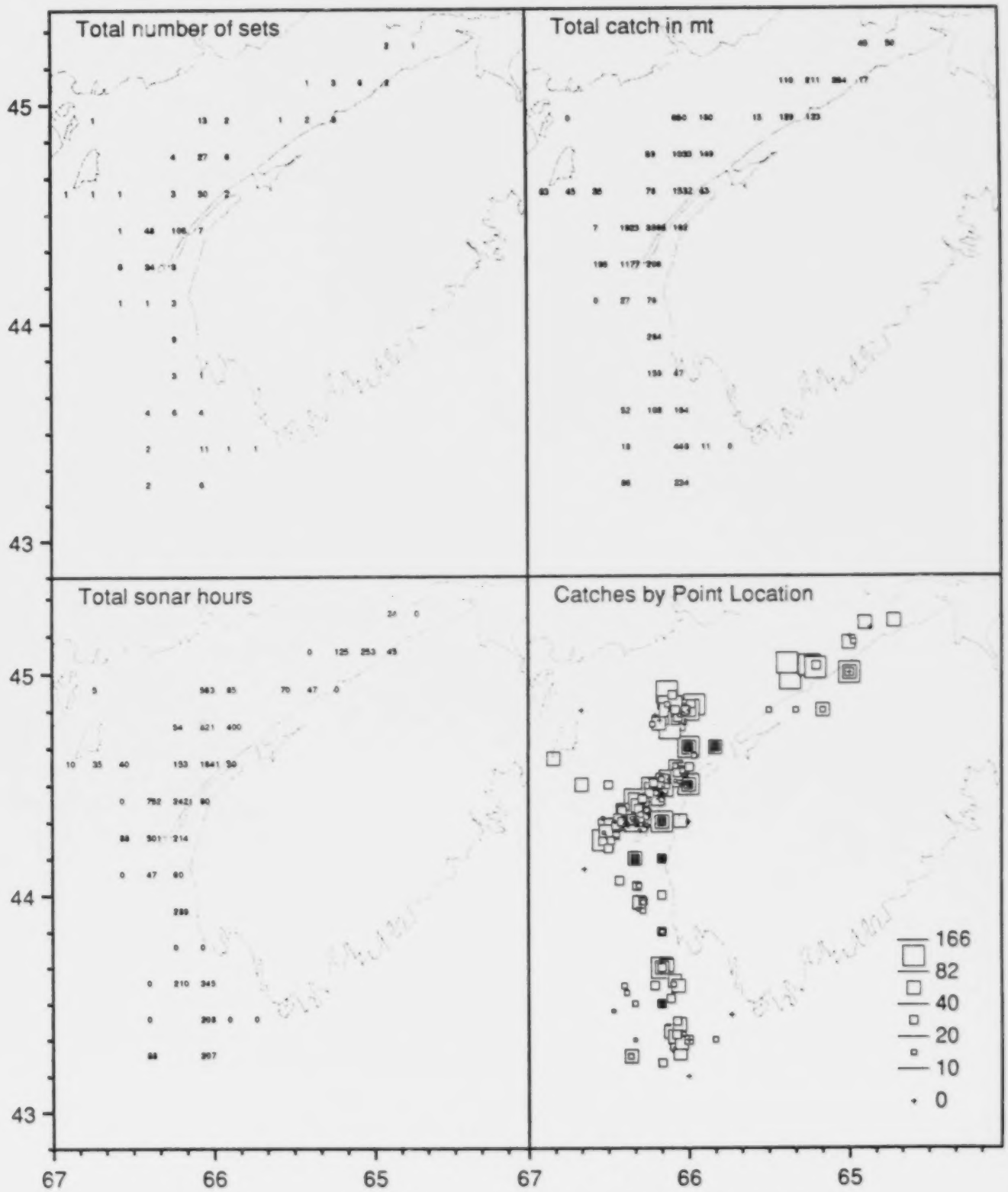

Figure 5c. 1990 4XA purse seine catch and effort distribution for OSS market.